OLE and the SAS® System for Windows Release 6.12

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ABSTRACT

This paper describes the OLE support within the SAS System for Windows Release 6.12. This support includes OLE container, OLE automation controller, and OLE automation server functionality. OLE container and OLE controller support is available in SAS/AF® FRAME entries and SAS/EIS® applications. OLE automation server support is available with base SAS software.

INTRODUCTION

This paper provides an overview of the OLE support in the SAS System. For more details on OLE in general, see the documentation for the Microsoft Windows operating environment. For further details on OLE support within the SAS System, refer to the online documentation for the SAS Companion.

OLE facilitates the exchange of information between applications. OLE containers include objects and controls from other applications. Through OLE automation, OLE controllers script objects in other applications. OLE servers are the applications that provide these objects.

OLE functionality within the SAS System falls into three categories: basic container support, OLE automation support, and OLE controls support. Each section of this paper discusses the particular OLE feature followed by specific information about its use within the SAS System.

BASIC CONTAINER SUPPORT

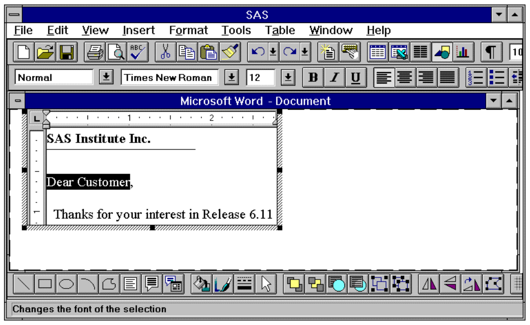
Overview of OLE

The SAS System's basic container supports the creation of Linked and Embedded objects, drag and drop, and visual editing.

Objects can be Linked or Embedded depending on your needs. Use Linked objects when you want the data in the container to update dynamically when the source changes. Use Embedded objects if you want to edit the object within the container or if a link would be unavailable later.

Drag and drop provides an easy way to create an Embedded or Linked object within a container. Drag and drop supports keyboard modifiers to alter the behavior of a drop. By default, dragging an object moves the object. To copy an object, hold down the Ctrl key when you drop the object in the container. The cursor will change to an arrow with a box and a plus (+) sign. To create a link to the object data, hold down the Ctrl and Shift keys when you perform the drop. The cursor will become an arrow with a box and an equals (=) sign. If the target area is not a valid drop site or the operation is not supported, the cursor will change to the not (∅) sign.

Visual editing allows you to edit an object within the context of its container. The container takes on the user interface of the server. The menus, toolbars, and status line switch to the ones normally provided by the server. Below is an example of a Microsoft Word object being visually edited in the SAS container.


SAS
File Edit View Insert Format Tools Table Window Help
Normal
Times New Roman
12
Microsoft Word - Document

SAS Institute Inc.

Dear Customer,

Thanks for your interest in Release 6.11

Changes the font of the selection

Not all servers support visual editing. Some servers may support open editing where the server launches as a separate application and all editing occurs in that application's window. By design, Linked objects only support open editing. Embedded objects may support visual editing or open editing depending on the server.

Overview of OLE and the SAS System

There are multiple ways to create Embedded and Linked objects with the SAS System. First, you need to bring up the SAS BUILD:DISPLAY window so you can create a FRAME entry that will contain your OLE objects. To do this submit the following statement:

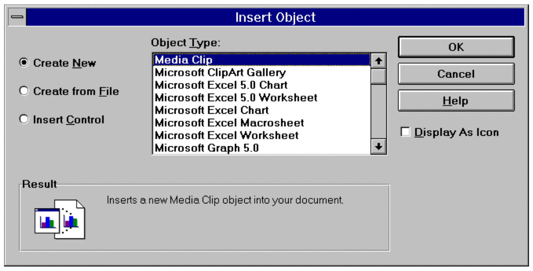
```
proc build c=sasuser.ole.demo.frame; run;
```

To create OLE objects you can select `FILL` or `MAKE` from the frame's popup menu. To access the popup menu, position your mouse in the BUILD window and click the right mouse button. When using `FILL`, you must first drag out a region to designate the size of the object. When using `MAKE`, the server determines the default size of the object. For bitmaps and other objects that do not scale well, `MAKE` is preferable because the object retains its appearance.

The SAS System creates HSERVICE entries in SAS Catalogs to store the necessary information about Linked and Embedded objects. These entries are only portable to other Windows platforms.

Creating OLE Objects in FRAME

One of the ways you can create OLE objects in FRAME is to use the Insert Object dialog. To access this dialog, select `MAKE` or `FILL` from the frame's popup menu. Scroll through the list of items and select `OLE - Insert Object`. The dialog is below.



(●) Create New
( ) Create from File
( ) Insert Control

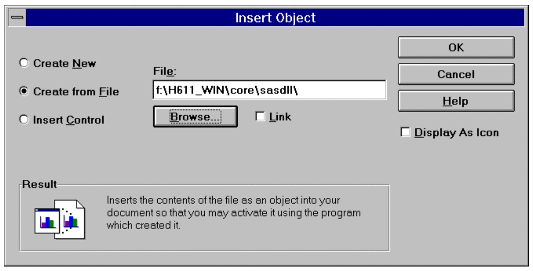
Object Type:
Media Clip
Microsoft ClipArt Gallery
Microsoft Excel 5.0 Chart
Microsoft Excel 5.0 Worksheet
Microsoft Excel Chart
Microsoft Excel Macrosheet
Microsoft Excel Worksheet
Microsoft Graph 5.0

☐ Display As Icon

Result
Inserts a new Media Clip object into your document.

Notice that there are three radio buttons in this dialog. The first one is `Create New`. Selecting this button will display a list of available object types. This list will vary based on the OLE-capable applications on your machine. Selecting an object type from this list and pressing `OK` will result in the creation of an Embedded object. Since this is a new instance of an object, the server starts the object in edit mode, either visual editing or open editing, depending on what the server supports. Click outside the object, elsewhere on the frame, to end visual editing. Exit the server to end open editing.

If you select the second radio button, `Create from File`, the dialog allows you to create an object based on the contents of a file. The dialog prompts you for the filename. The Insert Object dialog with this option selected is below.


Insert Object

( ) Create New
(●) Create from File
( ) Insert Control

File: f:\H611_WIN\core\sasdll\

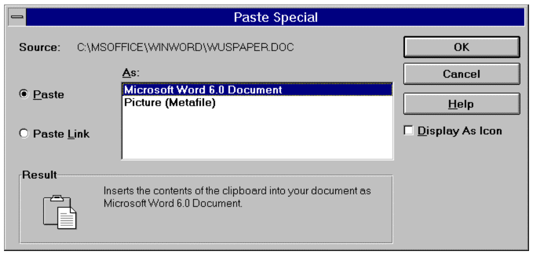
☐ Link
☐ Display As Icon

Result: Inserts the contents of the file as an object into your document so that you may activate it using the program which created it.

If you do not know the filename, you can browse for the file to use to create this object. Using this method will create an Embedded object based on the contents of the file. To create a Linked object, click the `Link` check box to select it.

The OLE Controls section describes the third radio button, `Insert Control`.

Another way to create a Linked or Embedded object is to use the Paste Special dialog. This dialog is available from the `MAKE` or `FILL` menus as `OLE - Paste Special`.


Paste Special

Source: C:\MSOFFICE\WINWORD\WUSPAPER.DOC

(●) Paste
( ) Paste Link

As:
Microsoft Word 6.0 Document
Picture (Metafile)

☐ Display As Icon

Result: Inserts the contents of the clipboard into your document as Microsoft Word 6.0 Document.

The Paste Special dialog allows you to create an object based on data from the clipboard. You may create objects of the following types: Embedded, Linked, Metafile, Device Independent Bitmap, or Bitmap. Select the desired choice and click the `Paste` button to create any type of object except Linked. You must select the `Paste Link` radio button to create a Linked object. Metafile, Device Independent Bitmap, and Bitmap are all static data representations of an object. You may view these objects in a container but not edit them.

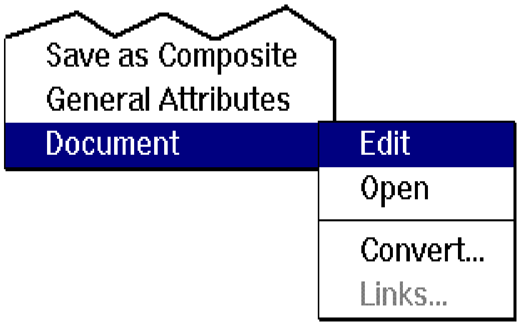
Another way to create an object is to read an existing object from a SAS catalog. To read an object from a catalog select `OLE - Read Object` from the `MAKE` or `FILL` menus. Enter the HSERVICE entry name of the object you want to read. Reading an object from a catalog is equivalent to copying an object. This method allows you to access objects in other frames. You must change the name of the HSERVICE entry in the Object Attributes dialog after you create the object if you want to save the object as a separate catalog entry.

You can also use drag and drop to create a new object based on an existing object or data in an application.

OLE Verbs

One important feature of OLE objects is that they expose verbs. Verbs are actions that can be performed on an object. Each OLE object has a default verb associated with it. Most objects expose "Edit" as the default verb. Some objects, such as media clip, expose "Play" as the default verb. The default verb is important because double-clicking an object in TESTAF executes this action. Most objects have more than one verb.

To access all the verbs for an object in BUILD, click on the object with the right mouse button to access the frame's menu. The name of the OLE object is the last item on the menu. This menu contains a list of selections available with this object. Below is a fragment of the frame's menu showing the object's menu.



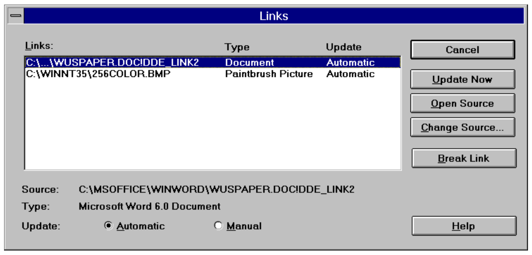
The first set of selections (before the separator) is the list of verbs. The first selection is the default verb. You can select any of these verbs to execute that action. Additional selections available from this menu include the Links and Convert dialogs.

You can also view the list of verbs for an object by invoking the Object Attributes dialog and selecting the Associated Verbs item. Using SCL, you can programmatically execute verbs using the _EXECUTE_ method. An example is below:

```
call notify('oleobj','_EXECUTE_','Edit');
```

The Links and Convert Dialogs

The Links dialog provides important functionality for the maintenance of OLE Linked objects. One particular function is the ability to repair broken links. Broken links may occur when you move a file that is the link source for an object. With the Links dialog you can change the location of the physical file that the link refers to, thus repairing the link. In the Links dialog you can also force an update of a link, edit the source of a link, or break a link. Breaking the link will change the object to a static representation. The Links dialog displays all Linked objects in the current frame. You can access the Links dialog by typing `DLGLINKS` on a command line or by using SCL to pass `DLGLINKS` as a verb to the object using the _EXECUTE_ method. In BUILD you can also access the Links dialog from the object's menu.



Links:	Type	Update
C:\...\WUSPAPER.DOC!DDE_LINK2	Document	Automatic
C:\WINNT35\256COLOR.BMP	Paintbrush Picture	Automatic

Source: C:\MSOFFICE\WINWORD\WUSPAPER.DOC!DDE_LINK2
Type: Microsoft Word 6.0 Document
Update: [✓ Automatic] Manual

The Convert dialog allows you to specify an alternate editor for an object when the original server is unavailable. If you convert an object, it permanently becomes an object of the new type. You can also use this dialog to activate an object as an object of another type. The storage for the object is unaltered and all objects of this type on your system will now use the new application for editing. Conversion and activation support depends on the servers installed on your system. One way to access the Convert dialog is to select an object and type `DLGCONVERT` on a command line. You also can use SCL to pass `DLGCONVERT` as a verb to the object. Additionally, in BUILD, you can access the Convert dialog from the object's menu.

OLE AUTOMATION

Automation allows an application to script another application. An OLE Automation Server is an application that exposes objects for scripting. These objects are OLE Automation Objects. Applications that access these objects are OLE Automation Controllers. Controllers provide a mechanism such as a script language to access automation objects and program automation servers.

You can control an OLE Automation Object through its methods and properties. Methods are functions exposed by an object. Properties are variables exposed by an object. The server's documentation describes its objects and their methods and properties.

SAS OLE Automation Server

The SAS System's automation server exposes one automation object to allow access to some features of the SAS System. The SAS System's automation object supports the following methods and properties:

Methods

Command
: executes the text as if it were entered on the command line of the SAS System session

Submit
: submits text to the SAS automation server for execution by the program editor

Quit
: ends the SAS automation session

QueryWindow
: determines whether a specified window exists within the SAS automation session

Top
: makes the SAS automation session the topmost application

Properties

Visible
: controls the visibility of the automation session

Title
: specifies the text for the main title bar

Busy
: indicates whether the automation session is currently doing work and is unable to process additional **Command** or **Submit** requests immediately

Wait
: determines when control will be returned to the caller

CommandWindow
: specifies the title of the window, e.g. "Program Editor", that will receive the command statements specified in the **Command** method

CommandWindowVisible
: determines the visible status of the **CommandWindow**, if it is specified

RC
: contains a return code that is set in the SAS System session using the "setrc" user written function

ResultString
: contains some text that is set in the SAS System session using the "setrc" user written function

Parent
: specifies the parent window of the SAS application session

X
: x position of SAS session window

Y
: y position of SAS session window

Width
: width of SAS session window

Height
: height of SAS session window

See Appendix A for a Visual Basic example that scripts the SAS System automation server.

The SAS System installation process updates the registration database with information necessary for the automation server. To start the server from an automation controller, you need its ProgID (programmatic identifier). The identifier for the server is "SAS.Application.612". Automation server support is available with base SAS software and is supported only on the Windows 95 and Windows NT platforms.

It is possible to have multiple automation controllers accessing one instance of an automation server. In Visual Basic, for example, the mechanism for accessing an existing instance of an automation server is GetObject, instead of creating a new instance with CreateObject.

One caveat is that the SAS System automation session will not close down until all the automation controllers that are accessing it have issued `Quit` requests or have closed down. For this reason, if the SAS System automation session is visible, be careful before manually shutting it down by double clicking the system icon or selecting Exit from the File menu. There is no way for the SAS automation server to notify controllers that the SAS automation session is going away, and the automation controllers may continue attempting to access it.

SAS OLE Automation Controller

As an OLE Automation Controller, the SAS System must provide a way to access OLE Automation servers and their OLE Automation Objects. SAS/AF provides the following SCL methods for this access:

NEW	creates an OLE Automation object
_SET_PROPERTY_	sets the value of a property
_GET_PROPERTY_	gets the value of a property
_DO_	invokes method that does not return a value
COMPUTE	invokes method that does return a value
_GET_REFERENCE_ID_	returns SCL reference identifier for the object

See Appendix B for an SCL example that uses these methods. You can also automate Linked or Embedded objects that exist in your FRAME by using these same SCL methods.

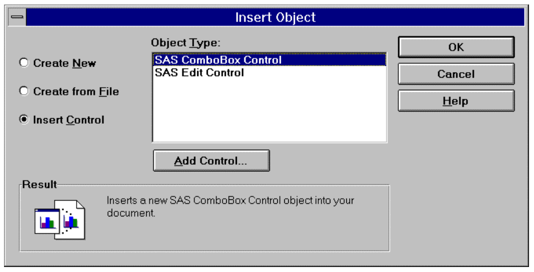
Many applications support Visual Basic to automate OLE servers. For example, you can use the macro recorder in Excel to capture the Visual Basic commands necessary to perform some functions. This code quickly translates into SCL. See Appendix C for an example of equivalent SCL and Visual Basic commands.

OLE CONTROLS

OLE controls, OCXs, are Embedded OLE objects with additional functionality. The main additions are support for ambient properties and events. Ambient properties allow communication between a container and an OCX for notification of property changes such as fonts and colors. For example, if the font in the container changes, the container will notify the OCX so it can change its font if applicable. Events are notifications generated by the OCX to the container. For example, a push button control might generate a click event.

Like Linked and Embedded objects, an HSERVICE entry within a SAS catalog stores the object information. When distributing a catalog that contains an OCX, you must copy the catalog as well as the OCX.

To use an OCX in a frame, you use the Insert Object dialog that was discussed earlier in the basic container section. From within this dialog select the `Insert Control` radio button. The dialog with this option selected is below.


Insert Object

Create New / Create from File / [✓ Insert Control]

Object Type:
SAS ComboBox Control
SAS Edit Control

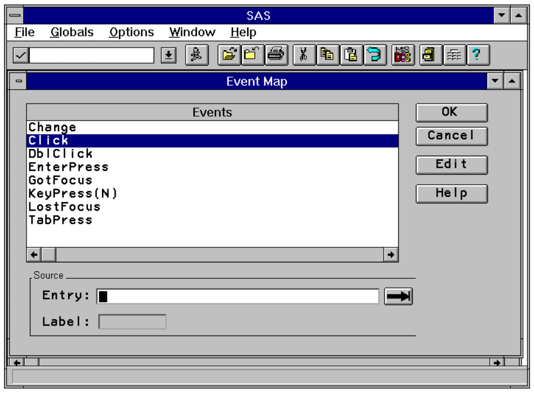
Result
Inserts a new SAS ComboBox Control object into your document.

The list of controls displayed will vary based on the controls installed on your machine. You can register new controls by selecting the `Add Control` button. Select a control from the list and click `OK` to create an instance of it in the frame. Alternatively, you can drag and drop a control in the frame from another application or paste one in from the clipboard using `OLE - Paste Special`.

OCXs provide a property sheet for access to some of the control's properties. To access the property sheet in BUILD, select the Properties verb from the object's menu. To access the property sheet using SCL, you send the Properties verb to the object using the _EXECUTE_ method.

To access all the properties and methods of a control, you use a subset of the SCL methods provided for automation. The SCL methods _GET_PROPERTY_ and _SET_PROPERTY_ access the properties of a control. The _DO_ and _COMPUTE_ SCL methods invoke methods of a control. You must know the names of the properties and methods for the object as well as any arguments. The documentation for the OCX should include this information.

OCXs generate events that you can respond to in your SCL code. In the SAS System you can view and map these events using the Event Map dialog. This dialog is below.



To access this dialog invoke the Object Attributes dialog from the frame's popup menu and select Event Map. You may now select an event and specify the name of the SCL, FRAME, or PROGRAM source entry and (if applicable) the SCL label where the event-handling code resides. You can edit the SCL for the event from this screen by pressing "Edit". When you map an event, you must compile the SCL outside of the frame in which the control exists.

CONCLUSIONS

This paper summarizes the support for OLE within the SAS System for Windows Release 6.12. Both OLE container support and OLE automation server support facilitate the exchange of information between SAS and other applications. OLE container support allows the use of third party developed objects within SAS/AF and SAS/EIS applications. OLE automation server support allows other third party applications to access some features of the SAS System.

REFERENCES

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APPENDIX A

This Visual Basic example creates an instance of the SAS automation server, submits code to the server, and closes down the server.

```
REM Create a button to invoke an automation server instance.
Private Sub StartBtn_Click()
  Set SASObj = CreateObject("SAS.Application.612")
  SASObj.Title = “Hat Graph”
  SASObj.Visible = TRUE
End Sub

REM Create a button to perform the calculations.
Private Sub ComputeHat_Click
  SASObj.Submit ("data hat;do x=-5 to 5 by .25;")
  SASObj.Submit ("do y=-5 to 5 by .25;z=sin(sqrt(x*x+y*y));")
  SASObj.Submit ("output; end; end;")
  SASObj.Submit ("proc g3d data=work.hat;plot y*x=z/ctop=red;")
  SASObj.Submit ("Title 'Cowboy Hat';run;quit;")
End Sub

REM Create a button to end the automation server instance.
REM Visual Basic requires that you set the object holder to Nothing to
REM break the connection.
Private Sub EndSAS_Click()
  SASObj.quit
  Set SASObj = Nothing
End Sub
```

APPENDIX B

This SCL example invokes Microsoft Excel, opens a worksheet, selects a range of cells, and charts them.

```
length rangeid $80;

/* create excel automation object */
hostcl = loadclass(’sashelp.fsp.hauto’);
call send (hostcl,  ’_NEW_’, excelobj, 0, ’Excel.Application.8’);
call send (excelobj, ’_SET_PROPERTY_’, ’Visible’,’True’);

/* open worksheet */
call send(excelobj, ’_GET_PROPERTY_’, ’Workbooks’, wbsobj);
call send(wbsobj, ’_DO_’, ’Open’, ’sales.xls’);
call send(excelobj, ’_GET_PROPERTY_’, ’ActiveSheet’, wsobj);

/* create a chart object */
call send(wsobj, ’_COMPUTE_’, ’ChartObjects’, chobjs );
call send ( chobjs, ’_DO_’, ’Add’, 144, 13.5, 287.25, 240.75 );
call send ( chobjs,  ’_DO_’, ’Select’ );
call send(excelobj, ’_GET_PROPERTY_’, ’ActiveChart’, chartobj );

/* get the range of cells to chart */
call send(wsobj, ’_GET_PROPERTY_’, ’Range’, ’C5’, ’D8’, rangeobj );
call send(rangeobj, ’_GET_REFERENCE_ID_’, rangeid);

/* chart the cells */
call send (chartobj, ’_DO_’, ’ChartWizard’, rangeid, -4098, 6,
  1, 0, 0, 1, ’Automation Demo!’, ’Column’, ’Value’, ’Row’ );
```

APPENDIX C

Visual Basic Code

```
‘Launch Excel and make it visible
Private Sub LAUNCHXL_Click()
  set excelobj =
  CreateObject (“Excel.Application.8”)
  excelobj.visible = TRUE
End Sub
```

OLE Automation with SCL

```
LAUNCHXL:
hostcl = loadclass(’sashelp.fsp.hauto’);
call send(hostcl, ’_NEW_’, excelobj, 0,
  ’Excel.Application.8’);
call send (excelobj, ’_SET_PROPERTY_’,
  ’Visible’, TRUE);
```

Visual Basic Code

```
‘Create a new worksheet
Dim wbsobj, wobj As Object
Set wbsobj = excelobj.Workbooks
wbsobj.Add
set wsobj = excelobj.ActiveSheet
```

OLE Automation with SCL

```
call send(excelobj, ’_GET_PROPERTY_’,
  ’Workbooks’, wbsobj);
call send(wbsobj, ’_DO_’, ’Add’);
call send(excelobj, ’_GET_PROPERTY_’,
  ’ActiveSheet’, wsobj);
```

Visual Basic Code

```
‘Set the value of a cell
wsobj.Cells(row+1, col).Value = var
```

OLE Automation with SCL

```
r = row+1
call send(wsobj, ’_COMPUTE_’, ’Cells’, r, col,
  retcell);
call send(retcell, ’_SET_PROPERTY_’, ’Value’,
  var);
```

Visual Basic Code

```
‘Close Excel
Private Sub EXITXL_Click()
  excelobj.ActiveWorkbook.Close(“FALSE”)
  excelobj.Quit
End Sub
```

OLE Automation with SCL

```
QUITXL:
call send(excelobj, ’_GET_PROPERTY_’,
  ’ActiveWorkBook’, awbobj);
call send(awbobj, ’_DO_’, ’Close’, ’FALSE’);
call send(excelobj, ’_DO_’, ’Quit’);
call send(excelobj, ’_TERM_’);
return;
```